



**United States Environmental Protection Agency
Office of Water
Office of Wastewater Management
Municipal Assistance Branch**

**Wastewater Treatment Plant Operator
On-Site Technical Assistance Training Program - 104(g)(1)
End of Year 2006 Accomplishment Report**



October 2007

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WASTEWATER OPERATOR TRAINING PROGRAM – 104(g)

Introduction

Section 104(g)(1) of the Clean Water Act authorizes funding for the Wastewater Treatment Plant Operator On-Site Technical Assistance Training Program. The 104(g) program provides on-site technical assistance to small¹ publicly-owned wastewater treatment facilities struggling with compliance and performance issues. This program protects human health, improves water quality, and safeguards capital investments and upgrades at these treatment plants. Federal funding is distributed to 46 States through grants, often in cooperation with educational institutions or nonprofit agencies. In many cases, the grants are administered by environmental training centers.

The 104(g) program works with facilities that have completed training as well as those where training continues. Facilities that have completed training have achieved the desired result and assistance is no longer needed. Training continues at facilities that have not yet achieved the desired result and require further aid and support to do so. Less than four percent of the facilities in the 104(g) program have chosen to opt out to pursue compliance through alternative methods. In the year 2006, at an average federal cost of about \$1,800 per facility, the program accomplished the following:

- Assisted 659 facilities;
- Achieved or maintained compliance, or improved performance at 566 of these facilities, a 86 percent success rate;
- Completed training at 335 of these facilities; and
- Achieved or maintained compliance, or improved performance at 316 of the 335 above-mentioned facilities, a 94 percent success rate.

Program Background

There are over 15,000 municipal wastewater treatment plants in the U.S., and out of those 15,000, almost 14,000 (>93 percent) discharge less than five million gallons per day (MGD). More than half of these plants have sophisticated activated sludge treatment technologies that require highly-developed operating skills. There have been about 11,000 enforcement actions against these small facilities. Out of these 11,000 enforcement actions, 10,121 were for facilities that have a capacity of less than one MGD. The operator turnover rates at small wastewater treatment plants are high, budgets and salaries are low, and community support is sometimes lacking. These are the ingredients for wastewater treatment plant noncompliance. Small community wastewater treatment plants experiencing noncompliance or technical problems that

¹ with effluent discharges of less than 5 million gallons per day

could result in noncompliance are candidates for the Wastewater Treatment Plant Operator On-Site Technical Assistance Training Program.

The goal of the program is to provide direct on-site assistance to operators at small community wastewater treatment facilities in order to help the facilities achieve and maintain consistent permit compliance. Consistent permit compliance maximizes the community's investment in improved water quality. The program is a cooperative effort with EPA regional office coordinators, States, State training centers, municipalities, tribes, and operators. Assistance focuses on issues such as wastewater treatment plant capacity, operation training, maintenance, administrative management, financial management, trouble-shooting, and laboratory operations. These organizations work in tandem with compliance and enforcement programs to improve water quality throughout the United States. The technical assistance is provided at no charge and the focus of the assistance is directed at noncapital intensive solutions. In return, the facility is expected to address factors limiting its performance. If the facility evaluation reveals a severe limitation in facility design capacity, the utility officials are directed to seek the services of a consultant or a design engineer. The utility benefits from an independent evaluation from the 104(g) trainers, who do not profit from any subsequent construction.

The 104(g) program assists small community wastewater treatment facilities in several ways, such as: identifying repairs or new construction necessary to meet existing or future permit limits, evaluating consultants and design review, recommending ways to improve preventive maintenance of equipment and structures, and reducing costs for energy and chemicals through more efficient operation techniques. Most importantly, the 104(g) program gets plant operating staff and local elected officials working together on the problems at the treatment plant, which improves water quality by maximizing treatment equipment efficiency.

The program was funded at the level of \$1.448 million in the fiscal year 2005. The EPA provided \$1.182 million for the Wastewater Operator Training Program in fiscal year 2006. In some cases, federal funds act as "seed money" for the program training centers to access additional funds for providing assistance. However, in other instances the only addition to the 104(g) allotment is the recommended 25 percent match from the grantee.

Recent Program Achievements

The Wastewater Treatment Operator Training Program, through the EPA regional offices and State partners, assisted 659 facilities in the year 2006. Compliance was achieved or maintained, or performance was improved, at 566 (86 percent) of these facilities.

Table -1 indicates that the majority of the work that was conducted in the program for the year 2006 resulted in achieving or maintaining compliance and improving performance at the facility. A good number of facilities that completed training activities in the year 2006 needed the assistance in achieving or maintaining compliance at the treatment plant site. The facilities that are continuing training activities from the year 2006 into 2007 still need assistance in the area of improving performance or achieving and maintaining compliance at the treatment plant location.

Out of the total of 335 facilities completed training in the year 2006, 316 (or 94 percent) achieved or maintained compliance, or improved performance. Compliance was achieved by 128 facilities, 133 maintained compliance, and 55 facilities improved plant performance (including compliance maintenance and preventing noncompliance). Nineteen facilities had no improvement and have decided to pursue compliance through alternative methods.

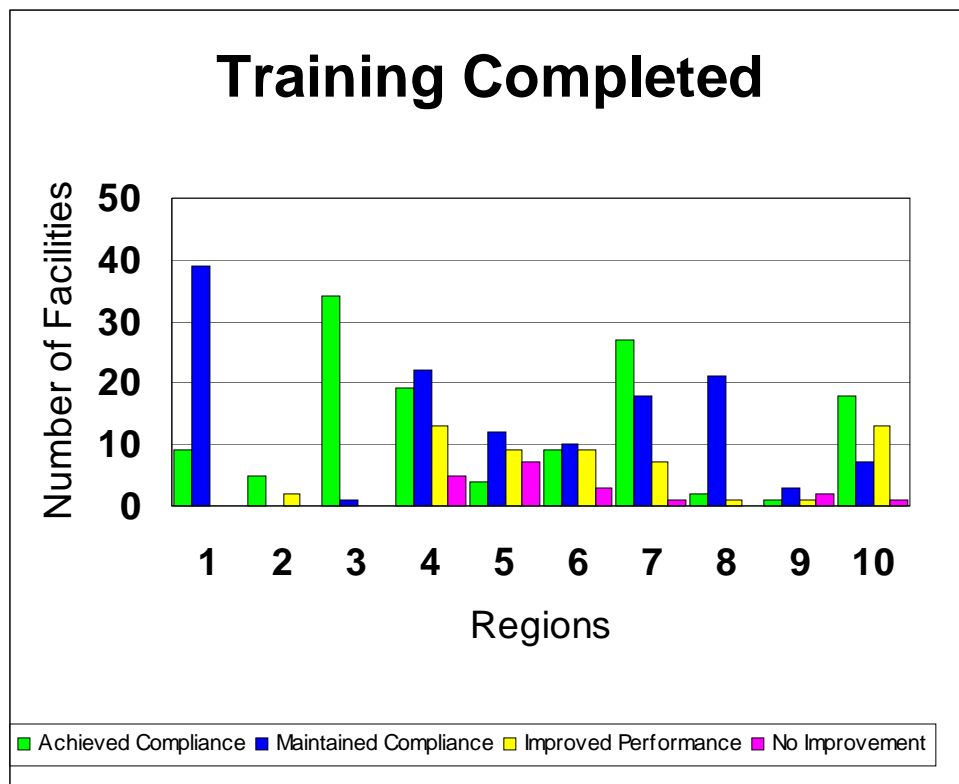
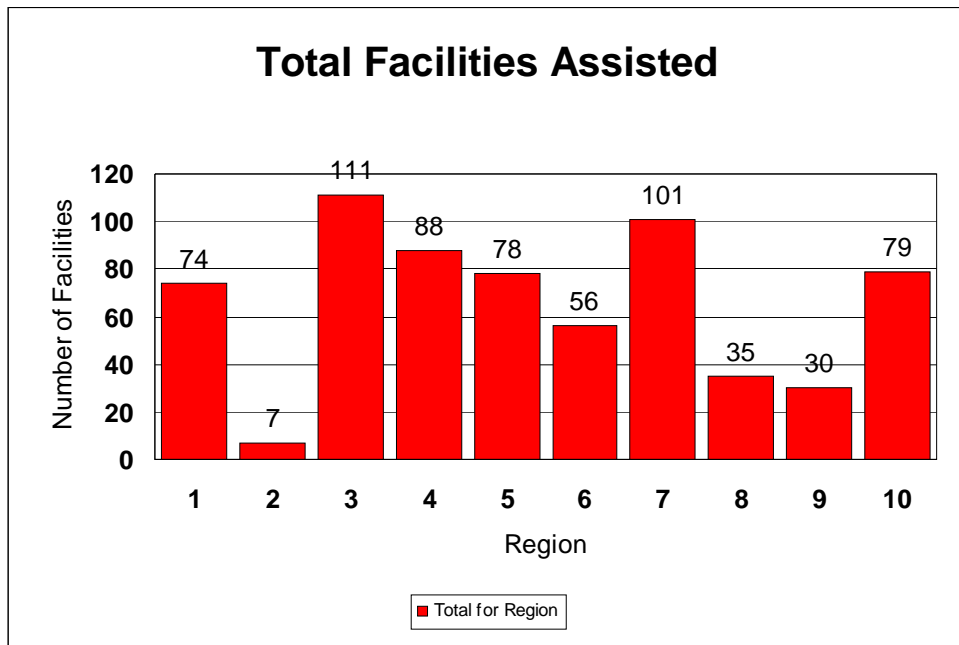
A total of 324 facilities will continue to receive training assistance into the year 2007. These facilities are still in need of assistance in order to improve performance and maintain long-term compliance. Seventy-nine of these facilities have achieved compliance, 60 maintained compliance, and 111 facilities improved performance. Seventy-four facilities had no improved performance but continue to pursue compliance through the 104(g) program.

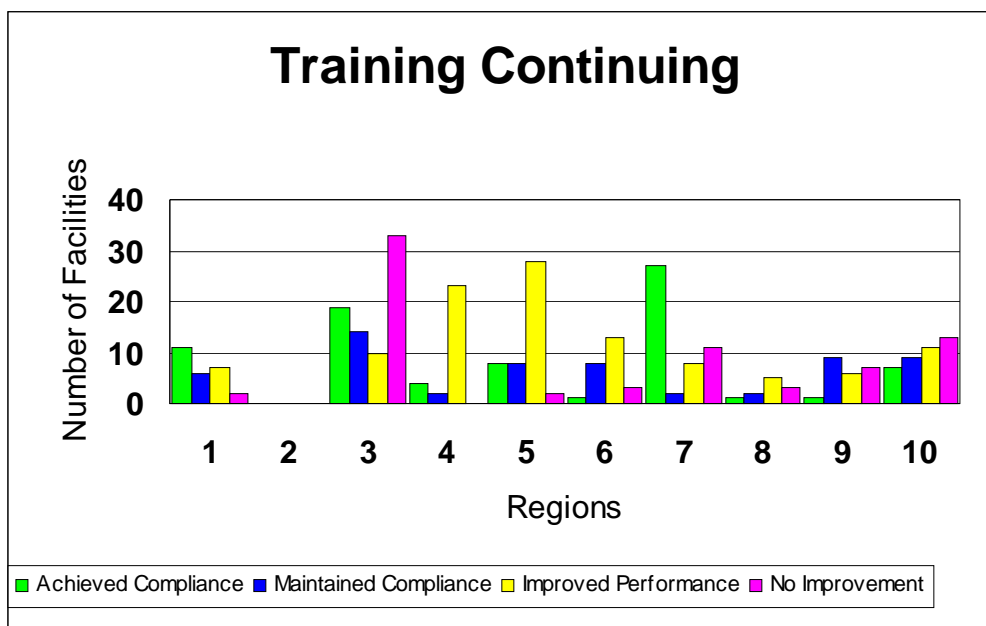
Of the 659 facilities assisted in the year 2006, 404 were new starts and 255 were “carry-overs” from the previous year. Table 1 summarizes the achievements of each EPA Region with the 104(g) program.

TABLE - 1
FACILITIES ASSISTED NATIONALLY IN ALL REGIONS

REGION	1	2	3	4	5	6	7	8	9	10	Total
TRAINING COMPLETED:											
ACHIEVED COMPLIANCE	9	5	34	19	4	9	27	2	1	18	128
MAINTAINED COMPLIANCE	39	0	1	22	12	10	18	21	3	7	133
IMPROVED PERFORMANCE	0	2	0	13	9	9	7	1	1	13	55
NO IMPROVEMENT	0	0	0	5	7	3	1	0	2	1	19
TRAINING CONTINUING:											
ACHIEVED COMPLIANCE	11	0	19	4	8	1	27	1	1	7	79
MAINTAINED COMPLIANCE	6	0	14	2	8	8	2	2	9	9	60
IMPROVED PERFORMANCE	7	0	10	23	28	13	8	5	6	11	111
NO IMPROVEMENT	2	0	33	0	2	3	11	3	7	13	74
TOTAL	74	7	111	88	78	56	101	35	30	79	659
CARRY-OVERS FROM PREVIOUS YEAR	15	0	63	22	55	14	28	12	8	38	255
NUMBER OF NEW PROJECTS FOR THIS YEAR	59	7	48	66	23	42	73	23	22	41	404

Details of number of facilities assisted, where training was completed or is continuing by Region is shown on the charts below.





In response to the incorporation of environmental outcomes into grant requirements the 104(g) program has developed a pollutant reduction tracking database. The pollutant reduction is calculated from the difference in the concentrations of nitrogen, total suspended solids, and Biochemical Oxygen Demand (BOD) existing in the wastewater treatment plant effluent prior to assistance, and the concentrations of those pollutants in the effluent after assistance had concluded. Although, all the States and training centers are requested to report the pollutant reduction loads achieved due to assistance provided, a good number of the facilities do not report pollutant reductions. The reasons for not reporting pollutant load information are lack of available process data and unavailability of equipment to monitor process conditions. The EPA has continued to encourage the training centers to provide the information for pollutant reduction loads to the extent possible, and the number of facilities reporting pollutant load reductions has increased steadily. For the facilities where assistance was completed in 2006 and results reported, the 104(g) program was responsible for the prevention of over four million pounds of pollutants being discharged into the waters of the United States.

The 104(g) program provides a variety of other benefits to the facility including better effluent levels, lower energy and chemical usage, more efficient use of staff time, and a more appropriate financial support system. The success stories presented later in this report demonstrate these benefits achieved due to efforts of the 104(g) trainers.

Table 2 on the next page summarizes the pounds of pollutants prevented from being discharged into the surface water by each EPA Region under the 104(g) program. The pollutant pound load calculation is based on the available information for the flow and the concentration of pollutants before and after the assistance is provided to the facility. In absence of the data, some of the loads are estimated based on the information available.

TABLE - 2

	Pounds of TSS removed	Pounds of BOD Removed	Pounds of Nitrogen Removed	Total pounds of pollutants removed in 2006
Region 1	199,179	124,971	605	324,755
Region 2	0	4,627	4,627	9,254
Region 3	150,516	24,348	38,175	213,039
Region 4	818,418	720,085	79,316	1,617,819
Region 5	189,422	177,833	105,185	472,440
Region 6	108,273	65,083	53,283	226,639
Region 7	127,770	159,802	4,320	291,892
Region 8	66,649	29,367	0	96,017
Region 9	0	0	0	0
Region 10	388,466	376,860	306,626	1,071,952
TOTAL	2,048,695	1,682,976	592,138	4,323,808

Success Stories

North Carolina

City of Thomasville, NC

The City of Thomasville Hamby Creek Wastewater Treatment Facility is currently nearing completion of a major upgrade, modification and expansion. The system has encountered compliance problems for Total Suspended Solids (TSS), nitrogen, BOD and phosphorous. Technical Assistance began in 2006 and the facility achieved compliance after the assistance.

The system experienced problems controlling solids concentrations due to sludge wasting procedures. The wasting system caused problems for the nitrification and total nitrogen reduction as well as BOD reduction and phosphorous removal. The operators investigated alkalinity levels throughout the system, developed a volatile solids profile, set up an oxygen uptake profile for the entire system and analyzed each aeration basin effluent for soluble BOD. It was determined that the improper coordination between the solids handling group and wastewater system operators was causing sudden increase of decanted liquid flow to the system. This information led them to improved methods to operate the plant and allowed them to better coordinate the operations of the treatment plant with the solids management section at the facility.

Utilizing the information gathered and the profiles developed, the operators were better able to understand the relationships between all of the functions at the facility. By capitalizing on this understanding, the facility reduced BOD, TSS, total nitrogen and phosphorous in the effluent. Another problem that needed to be addressed at the facility was infiltration and inflow (I&I). By understanding the impact of these problems, the operators are able to reduce the effect

of high flows through diversion to an equalization basin and make other operational adjustments when high flows are expected.

Texas

City of San Ygnacio, Texas

The city of San Ygnacio, Texas was operating the lagoons system to the best of its capabilities. It was noticed at the time of the evaluation on June 20, 2006, the system consisted of a series of three lagoons that were being operated at a very low water level. The problems that were identified at the time of the assessment included a high concentration of Total Suspended Solids (TSS), some debris floating in the ponds, and a lack of documentation on sludge transporters and adjustment of the material being disposed at the lagoons.

The system manager documented all the activities for sludge transporters and materials being disposed of at the treatment system, and started to implement the recommendations made at the time of the evaluation under the 104(g) program. These recommendations included raising the level of the lagoon system and removing debris from the ponds. At a follow up visit, it was noticed that the three pond system was working at normal capacity, the lagoons were operated with proper hydraulic conditions, and debris had been removed. The proper operation of the lagoons increased the retention time and lowered TSS.

Present view of lagoons



Maine

St. Agatha, Maine

Throughout 2005 and 2006, the technical assistance staff from the Maine Department of Environmental Protection (MeDEP) participated in a training and technical assistance effort with the staff of the St. Agatha Publicly Owned Treatment Works (POTW) in northern Maine. St. Agatha is a small town in the very northern part of Maine with a population of about 800. The

sewage system and POTW serve approximately 300 users. The sewage system and treatment facility are owned and operated by the town staff. The operating budget is approximately \$102,000/year with annual user fees of about \$340.00.

The POTW was visited by the trainer at the request of the inspector. The chief operator of the facility had resigned and the POTW was being operated by two operators from neighboring facilities under contract to the town. There had been two consecutive months of permit violations at the facility. The inspector and the town officials wanted to correct the situation before the POTW went into significant noncompliance.

Upon entering the facility, a distinct rotten-egg odor indicated a septic condition at the plant. This was confirmed by the conditions in the aeration basin and the secondary clarifier. What appeared to be fungi and other anaerobic growth were seen in a visual inspection of the aeration tank. A microscopic examination of the activated sludge showed significant fungi present and anaerobic floc appeared throughout the sludge.

While an O&M manual was supposed to have been prepared for the facility, there was no evidence of one present at the POTW. The operators were running the plant using their best judgment and experience from the other facilities they operated. The activated sludge return rate was set at over 600 percent of the influent flow. The operator commented that in his other plant, turning up the return sludge always seemed to help when he had a sour smell or other indication of septic conditions. The plant he normally operated had air-lift return pumps so increasing return flow added oxygen to the return sludge. At the St. Agatha POTW, the return pumps are centrifugal, so there was no concomitant increase in oxygen transfer when the return rate was increased. The Variable Frequency Drives (VFD) controlling the aeration blowers were set to 37 hertz.

It was recommended that the return sludge rate be set to about 150 percent of influent flow and, if the conditions did not improve in a week, the VFD on the aeration blowers should be turned up to about 42 hertz. Decreasing the return rate did not substantially improve conditions at the POTW, so the blower rate was increased. The plant quickly recovered and was operating within its permit limits less than a week after increasing the aeration rate.

The operators were given a copy of the MeDEP Process Control Manual. A process control plan was implemented in late 2005. A follow-up visit was conducted by Don Albert, P.E. and Ken Jones of the MeDEP Technical Assistance staff in March 2006. They found the POTW to be working well with a Sludge Volume Index (SVI) of 176, a Specific Oxygen Uptake Rate (SOUR) of 6 mg/hr/g and positive Oxygen Reduction Potential (ORP) readings throughout the facility. A microscopic exam of the sludge showed good floc formation, a good mixture of protozoa and some filaments, but not enough to inhibit settling. The plant was in good condition, clean and well-maintained. The operation had been well within permit limits for several months.

MeDEP staff worked with the operators to refine the Operation & Maintenance (O&M) manual and operating procedures. In October 2006, MeDEP recognized the two operators for their work to improve and maintain the performance of St. Agatha POTW.

Below are some 'Before and After' pictures showing conditions at the POTW before the first Technical Assistance (TA) visit and after the TA was completed.

This picture shows the surface of the secondary clarifier before technical assistance.



This picture shows the surface of the secondary clarifier after technical assistance was complete.





30 minute sludge settle-ability test results before technical assistance

30 minute sludge settle-ability test results after technical assistance



Pennsylvania

Lyons Borough, PA

In 1996, the Borough of Lyons, in Berks County, Pennsylvania, constructed a 200,000 gallons per day wastewater treatment plant. The plant uses the extended aeration treatment

process. Since its construction, the plant has experienced frequent violations of its discharge permit despite treating flows of only 110,000 gallons per day.

On March 30, 2004, a diagnostic evaluation was conducted on the plant. The evaluation team consisted of both State and EPA employees. The evaluation found numerous violations of suspended solids and ammonia. The diagnostic evaluation also identified several other problems:

1. The plant was suffering from a significant filamentous problem. This caused the sludge to not settle properly (bulk) and flow into the receiving stream.
2. The tanks in the plant were covered with thick, dark, and scummy foam.
3. The plant did not have a formal process control strategy.
4. Sludge was not being removed or “wasted” from the plant on a regular basis.

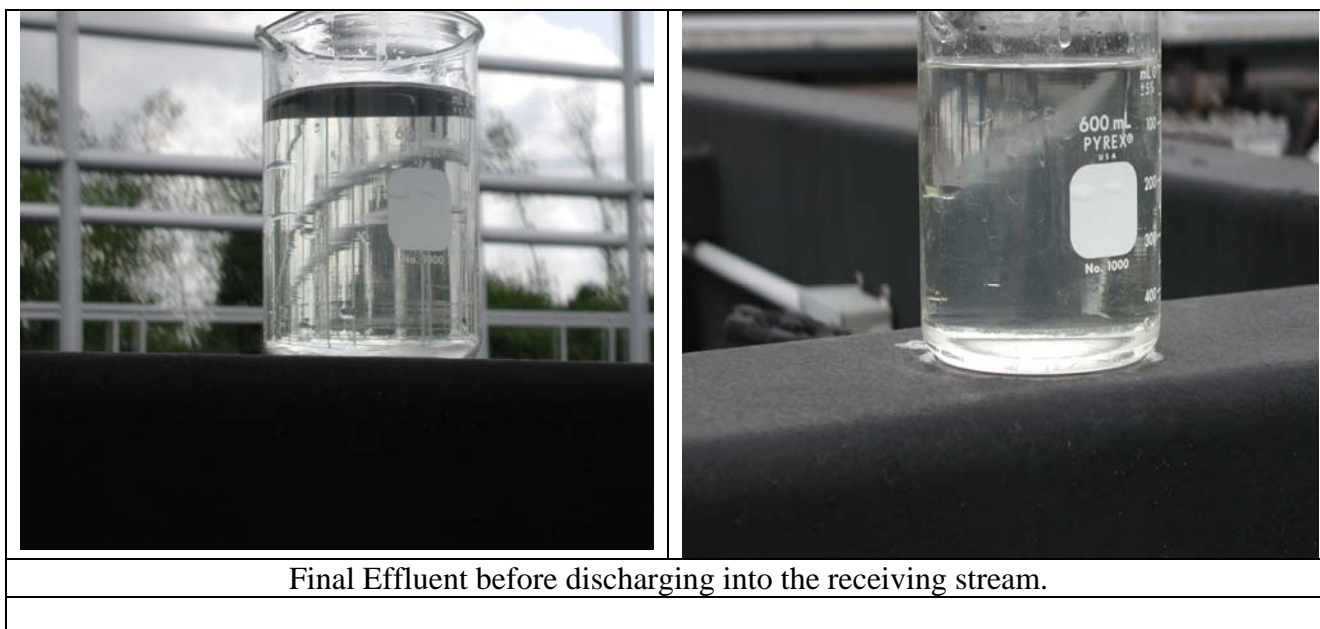


The diagnostic team issued their report with a strong recommendation that the plant staff invite the 104(g) Wastewater Operator Training Program to assist the community.

The 104(g) trainer developed a training program specifically for the plant. That program included the immediate control of the filamentous bacteria as well as developing a process control strategy.

The filamentous bacteria problem was controlled by injecting low concentrations of chlorine into the sludge return lines. However, it was not until the cause of the filaments, low food/microorganism ratio, was discovered and corrected that the problem was eliminated.

The process control program set target goals that included the amount of sludge that the plant needed to get rid of every day. Once the target goals were reached, the plant began to operate well within its permit limits.



Oklahoma

City of Pawnee, OK

The Pawnee wastewater treatment plant has shown the most improvement in the shortest amount of time. This is due largely to a very enthusiastic operator who wants to learn all he can to keep his plant running at peak efficiency.

In December 2006, the wastewater treatment system was in serious trouble. The current and only plant operator had only been with the city about three months. He had just obtained his D level certification (lowest level in Oklahoma) and had never worked at a wastewater treatment plant before. This new and inexperienced operator had an extended air-activated sludge treatment plant overloaded with solids. All four drying beds were filled with sludge. A sparsely equipped laboratory, which could barely run pH and settle-ability tests, was inefficient for the operator's needs. There was also evidence of solids carry over in the clarifier and into the chlorine contact chamber. The drying beds were not draining due to incorrect drainage material in the bottom of the beds. There was also serious inflow and infiltration (I&I) into the wastewater collection system. Most of the fence surrounding the wastewater treatment plant had fallen down and was lying on the ground.

With operator training, guidance, and financial support from the city, this wastewater treatment plant has made a dramatic turnaround. The operator and the city have completed 11 of the 13 items initially recommended to solve the issues with the wastewater treatment plant. An

engineering survey of the collection system identified the inflow and infiltration problems. Now, there is a complete fence with locking gates surrounding the wastewater treatment plant that is awaiting barbed wire installation. All four drying beds have had all of the old sand removed and new river sand installed to improve the draining of the drying beds. The operator has a sludge wasting and drying bed cleaning plan so that the aeration basin will not be overloaded with solids again.

The blower room which previously had only one operational blower and was filled with a lot of trash now has all three blowers operational and all of the trash has been cleaned up. The laboratory is now completely equipped to run all operational laboratory tests on the activated sludge. The laboratory has a new analytical balance, pH meter, oven and portable dissolved oxygen meter. When the laboratory equipment came in, the trainer provided training to the operator on all of the equipment. The operator passed the C laboratory operator test. He now runs all of the operational tests on the activated sludge and some of the compliance tests. The plant records are meticulously kept by the plant operator, with all laboratory records kept in a bound record book.

The solids concentration in the aeration basin started out in December 2006 at 950 milliliters (mls), for 30 minute sludge settle-ability, and is now running between 200 and 300 mls. The 30 minute sludge settle-ability was the only solids test the plant could run in December 2006. The chlorine contact chamber is now so clear you can see the bottom with no evidence of any solids. The effluent discharge into the creek is crystal clear with no evidence of any solids. Both effluent BOD and TSS have been averaging less than one-third of discharge limits.

If it was not for the financial support from the Environmental Protection Agency's 104 (g) (1) program, which provided the on-site assistance training, this wastewater treatment plant would still be in serious noncompliance.

Plans for the Future

The EPA Headquarters (EPA HQ) will continue to work with EPA Regional offices and State partners to improve water quality through the Wastewater Operator Training Program's assistance efforts.

The EPA HQ has reduced the burden of reporting by simplifying the pollutant reduction tracking database so that the trainers have to enter minimal data. Also, the Regional information provided to EPA HQ is in spreadsheet format to minimize the data reporting time. To improve the 104(g) program's image, EPA Regional offices and States have to ensure timely and accurate reporting of pollutant reduction loads and the number of facilities assisted. The trainers are also requested to provide specific accomplishments in reducing costs to the facility by saving energy, chemicals, or reducing other expenses.

The EPA will provide financial assistance for organizing the 25th National Operator Trainers Conference in Salt Lake City, UT, scheduled for summer 2008. EPA believes that this national conference is of substantial value to the State and training center trainers and enables them to learn about new equipment, methods, technologies, and processes that have recently

been developed for the operation and maintenance of small wastewater treatment facilities. The trainers also receive the opportunity to share their real-life experiences and solutions with one another and exchange information about the low-cost treatment methods the individual trainers have employed.

The program funding is also used by the States and tribes to manage training programs to increase the number of trained wastewater treatment plant operators. As noted by the American Water Works Association and Water Environment Federation the job market for water and wastewater treatment operators is a “buyers’ market.” The Water Environment Federation is also very concerned with the shortage of trained personnel for the small wastewater treatment facilities. The qualified operators are in short supply, and as always the small rural facilities are the ones who can not afford these expensive operators to run their plants smoothly and efficiently.

The EPA has formed a work group to discuss and resolve operator workforce issues. The group had several workshops and meetings to come up with ideas on how to promote professionalism, retention, recruitment, succession planning, infrastructure costs, and operator certification for the small water and wastewater treatment operators. The importance of educating utility decision makers was also discussed. The workgroup has come up with a preliminary workforce problem map with remedies that can reduce this burden for the small water and wastewater facilities. The EPA will gather additional information and research what the States are already doing in this area and further develop guidance on how to recruit, train, and retain the workforce for the small water and wastewater treatment facilities. This will give the small facilities access to trained operators so that they can better achieve and maintain compliance with the rules and regulations required by the States and EPA.

If you have any questions, comments, or require more information on this subject matter, please do not hesitate to contact Gajindar Singh at (202) 564-0634. You may also access the program's internet website at www.epa.gov/owm/mab/smcomm/104g/.

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